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10/039,635

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12/28/2005

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EXAMINER

JOHNSTON, PHILLIP A

ART UNIT

PAPER NUMBER

2881

DATE MAILED: 12/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/039,635

Applicant(s)

BLACK ET AL.

Examiner

Phillip A. Johnston

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18,20-29,31,32 and 37-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18,20-29,31,32 and 37-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Detailed Action

1. This Office Action is submitted in response to amendment filed 10-7-2005, wherein claims 19,30, and 33-36 were previously cancelled. Claims 1-18,20-29,31,32, and 37-42 are pending.

Claims Rejection – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-13,16-18,20,24-28, and 37-42 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Pub. No. 2004/0131843 to Mirkin, and Mirkin, U.S. Patent Pub. No. 2002/0063212, in view of Cubicciotti, U.S. Patent No. 6,762,025.

Mirkin (843) discloses the following;

(a) An apparatus and method for dip pen lithography where an SPM probe tip is coated with a pattern compound that includes a nanoparticle containing additive. The coating is applied by dipping the probe tip in a solution of the pattering compound, as recited in claims 1,2,10-13,20,24-27, and 37-42. See paragraphs [0015], [0053], and [0093];

(b) A variety of patterning compounds that include nanoparticles, as recited in claims 3,5, 6,38, and 42. See paragraphs [0056] – [0072], [0081] and [0089].

(c) The use of 13 and 20 nm nanoparticles, as recited in claim 4. See paragraphs [0109] and [0114].

(d) Forming a single row of 30nm nanoparticles, as recited in claims 7-9,16-18, and 38-42.

Mirkin (843) as applied above fails to teach the use of an adhesion layer, as recited in claims 1,6,24-28,37,38, and 42. However, Mirkin (212) discloses coating the SPM tip with an adhesion layer, as recited in claims 1,6,24-28,37,38, and 42. See paragraphs [0053] and [0054].

Therefore it would have been obvious to one of ordinary skill in the art that the nanolithography apparatus and method of Mirkin (843), can be modified to use the SPM tip coating of Mirkin (212), to provide an adhesion layer that will enhance the physisorption (adherence) of the patterning compounds to the tip.

It is implied herein that the use of nanoparticles in solution in accordance with Mirkin (843) and Mirkin (212) provides nanoparticles with an outer coating as recited in claims 1,4,5,10,24-28,32,37,38, and 42.

It is also implied herein that, the formation of a single row of nanoparticles using dip pen nanolithography in accordance with Mirkin (843) and Mirkin (212) includes attaching (affixing) a single layer coating of nanoparticles to the SPM tip, which is one nanoparticle thick, as well as attaching a single nanoparticle to the tip, equivalent to the limitations recited in claims 1,7-18,20,25-28, and 38-42.

Mirkin (843) and Mirkin (212) discloses the claimed invention except for having a specific value of length vs. width that is less than 15%, as recited in claims 1,10 and

24-28. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a nanoparticle having a value of length vs. width that is less than 15%, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

The combination of Mirkin (843) and Mirkin (212) fails to teach the use of spherical nanoparticles, as recited in claims 1,10,24-28,37,38, and 42. However, Cubicciotti (025) discloses that, separation of the surfaces is achieved by template-directed attachment of an effector molecule; e.g., a nanosphere to a first surface. See Column 39, line 41-52.

Cubicciotti (025) also discloses that, proximity-based methods for single-molecule detection include proximal probe methods (e.g., AFM, STM) with reporter molecules (e.g., macromolecules, polymers or preferably nanoparticles or microparticles) to select and isolate one or more aptamers based upon a user-defined selection criterion or setpoint (e.g., target-binding affinity).

Single-molecule affinity selection can be achieved by immobilizing a target molecule to an SPM tip (i.e., negatively charged silicon nitride) used to probe a random-sequence, nanosphere-conjugated nucleic acid library. Scanning is performed in fluid mode to detect aptamer binding to the tip-immobilized target following application of the nucleic acid library sample to a freshly cleaved mica substrate, as recited in claims 1,10,24-28,37,38, and 42. See Column 157, line 46-67; and 158, line 1-10.

Therefore it would have been obvious to one of ordinary skill in the art that the nanolithography apparatus and method of Mirkin (843) and Mirkin (212), can be modified with the nanosphere's of Cubicciotti (025), to provide Single-molecule selection methods for identifying target-binding molecules from diverse sequence and shape libraries.

4. Claims 14,15, 21-23,28, and 29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mirkin (843), Mirkin (212) and Cubicciotti (025) and in further in view of Colbert, U.S. Patent Pub. No. 2003/0106998.

The combination of Mirkin (843) and Mirkin (212) and Cubicciotti (025) fails to teach the use of cured and annealed adhesion layers on a probe tip; however, Colbert (998) discloses;

(a) The use of thin adhesive layers prior to coating the probe tip with nanoparticle solutions, and the use of UV and annealing as recited in claims 21-23. See paragraphs [0055]-[0058] and [0168].

(b) Dipping a probe tip into electrochemical solution and applying electrical potentials to the probe, as recited in claims 14,15,28 and 29. See paragraph [0034] and [0060].

Therefore it would have been obvious to one of ordinary skill in the art that the nanolithography apparatus and method of Mirkin (843), Mirkin (212) and Cubicciotti (025) can be modified to use the probe tip attachment methods of Colbert (998) to provide strong, reliably mounted probe tips thereby improving conventional microscopy techniques.

Examiners Response to Arguments

5. Applicant's arguments filed 10-7-2005 have been fully considered but they are not persuasive.

Arguments

Numerous arguments are contained in the Remarks filed 10-7-2005. The examiner has determined that all the arguments contained therein are dependent upon the persuasiveness of the following central argument regarding the Mirkin references.

Applicant states that, "The Applicants respectfully but strongly disagree that Mirkin 843 discloses what the Office Actions says it does. Examiner cites paragraphs (0015), (0053), and (0093) as evidence for the above disclosure. However, in none of these paragraphs, or for that matter in any other paragraph, does Mirkin 843 discuss any 'nanoparticle containing additives.' Mirkin 843 discusses many different possible patterning compounds in paragraphs (0055) - (0074), however they are all different types of molecules, and not nanoparticles as in the Applicants' claimed invention."

The applicant is first respectfully directed to Applicants specification, paragraph [0013], which states; The method of forming the scanning probe microscope tip comprises coating a scanning probe microscope tip with an adhesion promoter, dipping the tip through a layer of nanoparticles floating on a liquid subphase, and withdrawing the tip from the liquid subphase. Other methods of forming the scanning probe microscope tip include inking an elastomeric stamp with nanoparticles on it, and sticking the microscope tip into the elastomer, submerging the tip into a solution of

dispersed nanoparticles, and using electrostatic and electrochemical methods to attach the nanoparticles to the tip, and finally using lithographic techniques to attach the nanoparticles to the tip. After the nanoparticles have been affixed to the tip, chemical and physical treatments may be applied to the tip to impart to it desired properties. Heat, laser light, or a beam of electrons may be applied to the tip to strengthen the adhesion between the nanoparticles and the tip.

The applicant is next respectfully directed to Mirkin (843), paragraphs [0015], [0053] and [0093], which state in part;

[0015] Finally, the invention provides an improved method of dip pen nanolithography. The method comprising performing dip pen nanolithography by providing a substrate and a tip, coating the tip with a solution of a patterning compound, and contacting the coated tip with the substrate so that the compound is applied to the substrate so as to produce a desired pattern. The improvement comprises providing the patterning compound in a solution comprising an additive.

[0053] Alternatively and preferably, the patterning compound is applied by forming a drop of a solution of a patterning compound on the tip that is to be used to produce a pattern of the patterning compound. This can be accomplished by bringing the tip into contact with a solution of the patterning compound.

[0093] A structure-forming compound may be any compound that reacts chemically or otherwise stably combines (e.g., by hybridization of two complimentary

strands of nucleic acid) with the patterning compound(s) or with the resist of the foundation layer. The structure-forming compound may be one of the patterning compounds described above or a functionalized patterning compound. By "functionalized" is meant that the patterning compound has been altered chemically (e.g., a carboxylate group has been reacted with an alcohol to produce an ester or has been reacted with an amino acid to produce a peptide linkage, etc.) or has a physical material (e.g., a nanoparticle) attached to it.

The applicant is also respectfully directed to Mirkin (212), paragraphs [0053], and [0054], which state in part;

[0053] Most preferably, the SPM tip is an AFM tip. Any AFM tip can be used, and suitable AFM tips include those that are available commercially from, e.g., Park Scientific, Digital Instruments and Molecular Imaging. Also preferred are NSOM tips usable in an AFM. These tips are hollow, and the patterning compounds accumulate in the hollows of the NSOM tips which serve as reservoirs of the patterning compound to produce a type of "fountain pen" for use in DPN.

[0054] The tip is also preferably one to which the patterning compound physisorbs only. As used herein "physisorb" means that the patterning compound adheres to the tip surface by a means other than as a result of a chemical reaction (i.e., no chemisorption or covalent linkage) and can be removed from the tip surface with a suitable solvent. Physisorption of the patterning compounds to the tip can be enhanced by coating the tip with an adhesion layer and by proper choice of solvent (when one is used) for the patterning compound.

The examiner has interpreted from both the Applicants and the Mirkin references above that Mirkin clearly discloses, first coating an SPM tip with an adhesion layer, then dipping the tip into a patterning compound containing nanoparticles, which causes the compound containing the nanoparticles to affix to the scanning probe microscope tip, in precisely the same manner proposed in the applicants specification, and as recited in the applicants independent claims 1,10,25-28,37,38, and 42.

In addition, after the nanoparticles are affixed to the tip in accordance with Mirkin (843) and Mirkin (212), it is obvious that the chemical and physical techniques of Cubicciotti (025) and Colbert (998) also disclosed in the above rejection would have been available to Mirkin for applying to the tip, so as to perform imaging applications with an SPM or AFM probe tip, which Mirkin, Cubicciotti, and Colbert seek in common.

Finally, the examiner wishes to point out that the applicants claimed improvement is based on the use of an adhesion promoter to affix a layer of nanoparticles to an SPM probe tip. Since the use of the term "affix" is not defined in the specification, the normal definition of the term affix is being used herein; i.e., physically attaching. As a result the examiner interprets from the Mirkin references that a patterning compound (a solution) containing nanoparticles is physically attached to an SPM probe tip, after an adhesive coating is first applied to the tip.

Conclusion

6. The Amendment filed on 10-7-2005 under 37 CFR 1.131 has been considered but is ineffective to overcome the Mirkin (843), Mirkin (212), Cubicciotti (025) and Colbert (998) references.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 6:30 am to 3:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (571) 272-2477. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

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PJ
December 16, 2005


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